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U.S. Forests and Atmospheric Deposition

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16. ABSTRACT

Forests in the United States occupy 33 percent of the nation's land area and exist on some lands in all fifty states. They cover approximately 299 million hectares and are rich in essential resources. Overall, U.S. forests are highly productive. However, in recent decades, several cases of forest decline on a regional scale have occurred which are not easily explained by normal natural causes. Atmospheric deposition of air pollutants is suspected to play a causal role in many of these cases. The evidence, however, is largely circumstantial in that forest areas with decline symptoms are frequently located where the deposition of pollutants is high. Proof of cause and effect has been illusive. Ozone at concentrations elevated by human activities has been proven to cause declines in some area, but many other wide-spread declines remain unresolved.

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U.S. Forests and Atmospheric Deposition

Jack K. Winjum

EPA Environmental Research Laboratory, Corvallis OR

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Forests in the United States occupy 33 percent of the nation's land area and exist on some lands in all fifty states (USDA Forest Service, 1982). In total, they cover approximately 299 million hectares and are rich in essential resources such as water, wildlife, timber and recreation opportunities.

In general, U.S. forests may divided into three large regions (Figure 1):

1. The Eastern forests consisting of the northern mixed conifer-hardwood type, the central mixed hardwood type and the southeastern pine type. The total area is 156 million hectares.

2. The Western forests which are predominately coniferous types divided between the Rocky Mountains and the areas along the Pacific Coast. These forests occupy 94 million hectares.

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3. The Alaska forests which are a combination of coastal conifer types and interior mixed conifer-hardwood types for a total of 49 million hectares.

The Eastern and Western forests lie between the 30th and 49th latitudinal parallels and therefore are predominantly in the temperate vegetation zone (Good, 1964). However, small areas of tropical forests exit in southern Florida and in Hawaii, and the interior forests of Alaska are boreal.

Historically, climates and mountain ranges have had a major influence on forming forests. In the U.S., the West Coast climate is maritime with cool winters of heavy precipitation and short dry summers. Eastward across the 48 contiguous states the climate is continental with quite cold winters and hot, humid summers. Major mountain complexes are the Appalachian Mountains which parallel the East Coast; the stairstep order (low-to-high) of the Pacific Coast Range, the Cascade Range-Sierra Nevadas and the Rockies in the West; and the Aleutian-Alaska Ranges along the Pacific Coast of Alaska with the Brooks Range in the northern interior.

In total, the U.S. forests represent about 10 percent of the world's 2.85 billion hectares of forests. By comparison, the USSR has 790 million hectares of forest lands or nearly 28 percent of the world's total (USDA Forest Service, 1973).

Superimposed over the natural distributions of U.S. forests is the human infrastructure. Ownerships include federal, state, municipal and private lands. In broad terms, the federal government owns 21 percent of nation's forest lands; state and municipal represent 8 percent; large private (i.e. the forest industry) have 14 percent and small private total the largest at 57 percent. Much of the latter consists of parcels less than 200 hectares in size. Such a complex system of multiple ownerships is rare among the forested nations of the world and, while fundamental to a free society, often presents a significant obstacle to developing and implementing nation-wide forest policies.

Overall, U.S. forests are highly productive providing a high degree of ecological diversity as well as abundant wood, water and recreation to meet basic human needs. Forest health, with few exceptions, has generally been good through the first two-thirds of this century. Indeed, forest science has developed the technology to double or triple the wood yields on many areas of commercial forest land over that of natural stands while maintaining or increasing the productivity of other forest resources.

However, in recent decades, several cases of forest decline on a regional scale have occurred in the U.S. which are not easily explained by normal natural causes. Examples are the pine-fir forests of the southern Sierra Nevadas in California and red spruce-true fir forests of the Appalachian Mountains in the

East (NAPAP, 1987). In these cases, significant foliar damage has occurred and in some instances this has led to growth losses and increased mortality throughout many stands. To a lesser degree, the same symptoms have been noted in several other forest regions.

Atmospheric deposition of air pollutants is suspected to play a causal role in many of these cases. The evidence, however, is largely circumstantial in that forest areas with decline symptoms are frequently located where the deposition of pollutants is high. Though it must be remembered that in many of these areas stresses due to natural factors such as drought or winter cold extremes also occur. Pollutants of concern are compounds resulting from anthropogenic emissions of sulfur dioxide (SO2), oxides of nitrogen (NOx) and volatile organic compounds (VOCs) including associated oxidants such as ozone (O3). Both wet and dry deposition may be involved. Furthermore, combinations of these pollutants with natural factors as mentioned above are likely possibilities.

Proof of cause and effect has been illusive. Ozone at concentrations elevated by human activities has been proven to cause declines in the ponderosa-jeffrey pine stands in the southern Sierra Nevadas in California and to eastern white pine throughout the eastern U.S. But many other wide-spread declines remain unresolved.

Forestry research programs have addressed the issue over the last 25 years and most intensively during this decade. A comprehensive summary document on the air pollution situation in the U.S. is under preparation by the National Precipitation Assessment Program (NAPAP). Plans call for publications in 1990. Sections on forest effects will form one of the fundamental portions of the 1990 Assessment Document. Based on this information, U.S. policy makers will make new decisions about the need for more intensive regulation of air pollutant emissions.

References:

Good, R. 1964. The geography of the flowering plants. John Wiley & Sons, NY. 518 pp.

USDA Forest Service. 1982. An analysis of the timber situation in the U.S. 1952-2030. Forest Resources Report No. 23. 499 pp.

USDA Forest Service. 1973. Outlook for timber in the United States. Forest Resources Report No. 20. 350 pp.

NAPAP (National Acid Precipitation Assessment Program). 1987. Forest Effects. Interim Assessment, Volume IV, Chapter 7. p. 1-7 to 7-59.

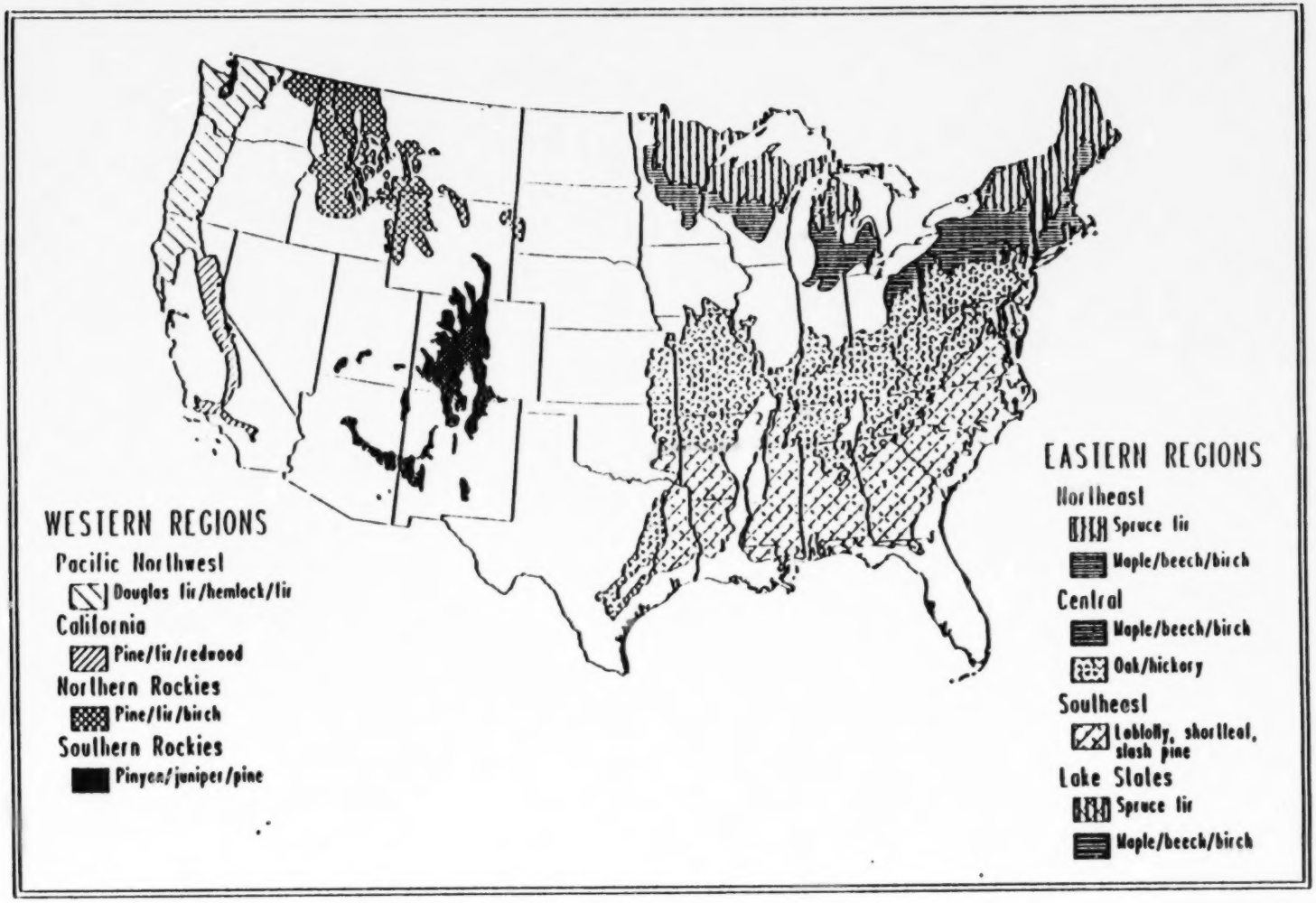

Figure 1. Major Forest Regions of the ~~Conterminous~~ United States and Their Primary Tree Groups

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